

**Case 00-OC091/US**

**\*INTERROGATION AND RESPONDER SYSTEM\***

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## **INTERROGATION AND RESPONDER SYSTEM**

### **FIELD OF THE INVENTION**

The invention relates to an interrogation and responder system.

### **BACKGROUND OF THE INVENTION**

A laser identification/simulation system with a laser device for identifying a responder device is known from European Patent Application **97 120818.6** (Publication No. **EP 0 859 243 A1**). The laser device is designed for transmitting a coded laser beam, wherein the responder device has sensor means for detecting the laser beam and for converting it into electrical signals, which are passed on to an evaluation unit, as well as transmitting means for returning messages in accordance with decisions made in the evaluation unit to receiving means located inside or outside of the interrogation system. This interrogation system is designed to send a tight directional laser beam and contains chopping means for sending out a laser beam which is not only coded, but also chopped with a predetermined frequency. The sensor means of the responder device include means for obtaining an electrical signal from the received chopped laser beam, which is supplied to a pre- amplifier, which is connected upstream of the discriminator.

Such a system is mounted in weapons which are normally used by soldiers, wherein all participants in an exercise, both persons and objects, can be equipped with detectors, which register a possible weapons effect on the participant. The functioning of such known systems represents the basis of a friend-foe identification system (IFF), which can also be used in accordance with the present invention.

## OBJECT AND SUMMARY OF THE INVENTION

It is now the object of the present invention to create a further system of this type, which avoids or reduces the disadvantages of known systems.

~~In accordance with the invention, this object is advantageously attained by means of a system in accordance with claim 1.~~

Further advantageous embodiments of the invention ensue from the further dependent claims.

The invention will be explained in greater detail in what follows by means of different drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

**Fig. 1** shows a schematic representation of a transmitting device (interrogation system) in accordance with the invention,

**Fig. 2** shows a schematic representation of a receiving device (responder device) in accordance with the invention,

**Fig. 3** represents a diagram for explaining the information signals used.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The interrogation system **10** in accordance with **Fig. 1** comprises a circuit **11**, which can be mounted on a weapon and which has an antenna **12**, which can be integrated into the circuit **11**, and a modulator **13**, to which at least one terminal **14**, as well as a central unit **15** can be connected. The terminal **14** is, for example, provided with a keyboard and/or a display and/or a microphone and/or a headset, etc. The circuit **11**, which is designed as an active transmitter, can generate single pulses or short bursts of pulses (for example by means of an oscillator), which are very short but nevertheless have relatively large energy. Receiving means **16**, **17** are connected to the central unit **15** of the interrogation system **10**, which are located inside or outside of the actual interrogation system **10**. The receiving

means 16, 17, which can also be connected to one of the mentioned terminals 14 and/or also to other terminals, comprise a receiver device 16 and an antenna or a sensor 17, for example. In place of the structure represented in Fig. 1, the interrogation system 10 can have a communications bus, for example.

a 5 The responder system 20 in accordance with Fig. 2 comprises <sup>receiver</sup> a circuit 21 with <sup>a receiver</sup> an antenna 22, which can be integrated into the circuit 21. The responder system 20 can contain a demodulator or evaluation unit 23, for example, for evaluating the received electromagnetic waves, to which at least one terminal <sup>terminal</sup> 24 and a central unit 25 are connected.

a 10 The terminal 24 can be provided, for example, with a display and/or a headset and/or a microphone. The circuit 21, which is designed as a receiver, can for example comprise a detector and, if required, an amplifier, which process pulses or bursts of pulses received by the antenna 22. Transmitting means 26, 27 are connected to the central unit 25 for returning messages in accordance with decisions made in the evaluation unit to receiving means 16, 17 (Fig. 1) of the interrogation system. The transmitting means 26, 27, which can also be located inside or outside of the actual responder system 20, for example comprise a transmitting device 26 and a transmitting antenna 27.

15 The system in accordance with the invention now functions as follows:

20 The persons and objects (tanks, etc.) participating in an exercise can carry at least one receiver 21, 22, preferably with the aid of a harness system in accordance with European Patent Applications EP 0 859 243 A1 and/or EP 0 836 068 A1 and/or EP 0 836 069 A1. Incidentally, the subject of the present invention can comprise all means mentioned in the above patent applications for carrying out all functions known from these patent applications in the same or similar manner.

25 Three pulses 31, 32, 33 on the order of picoseconds are represented in Fig. 3 by way of example. This corresponds to an oscillation frequency of 10 to 1000 GHz and a wave length of 30 to 0.3 mm. Since, because of this, the required antenna 12 need only have relatively small dimensions, it can be designed in such a way that it can be mounted on the weapon. Moreover, if desired, the antenna 12, together with an oscillator, can be integrated in the circuit 11. Signals delivered from a terminal 14 cause a modulation and/or a coding in the modulator 13 of the control signals for the oscillator in such a way, that the pulses 31, 32, 33 are triggered at different intervals. Thus, these pulses contain the information to be transmitted. With an appropriate shaping of the antenna 12 it is possible to transmit the pulses 31, 32, 33 in a directed, or respectively directional manner. The manner of transmission employed here is also known as ultra-wide spread spectrum transmission. It has been found that this type of transmission has various properties, which make the advantageous realization of the systems in accordance with the invention possible. Such systems can be constructed to be small and energy- saving. With this type of communications it is also possible to determine the distance to the target (responder device).

A further important advantage is that the communications principle employed here is difficult to detect for third parties.

The radiation characteristics of the interrogation system 10 can be directed as desired by means of a suitable antenna 12. With an appropriate antenna 12 it is possible to achieve an angle of the radiated lobe of up to 30 mrad. The layout and the dimensioning of antennas is sufficiently known to one skilled in the art.

The pulses 31, 32, 33 received via the antenna 22 in the receiver <sup>Circuit</sup> 21 are detected and preferably also amplified. It is then possible to generate from the detected pulses <sup>34, 35, 36</sup> ~~31, 32, 33~~ information pulses 37, 38, 39 (for example in rectangular form), which can easily be much longer than the pulses 31, 32, 33, and can also be chronologically displaced. Information provided in coded form by means of the different spacing d1, d2 between the individual pulses 37, 38, 39 is deciphered in the demodulator 23 and is provided in a suitable electrical form to at least one of the terminals 24, 25. The responder system 20 can be designed, for example, for radiating response signals and/or echo signals via the transmitting means 26, 27, which can be received by the <sup>receiving</sup> ~~sensu~~ means <sup>16, 17</sup> ~~11, 12~~ of the interrogation system 10. A distance measurement between the interrogation system 10 and the responder system 20 is made possible by this. This means that the marksman performing the interrogation can even measure the distance to his target (the responder system 20). This has the advantage that, in case two objects located behind each other are illuminated, the soldier has the additional possibility of estimating which signal is more realistic.

In place of individual pulses 31, 32, 33 it is also possible to transmit bursts of pulses which, if necessary, are damped and/or harmonic and/or inharmonic, for the purpose of interrogation.